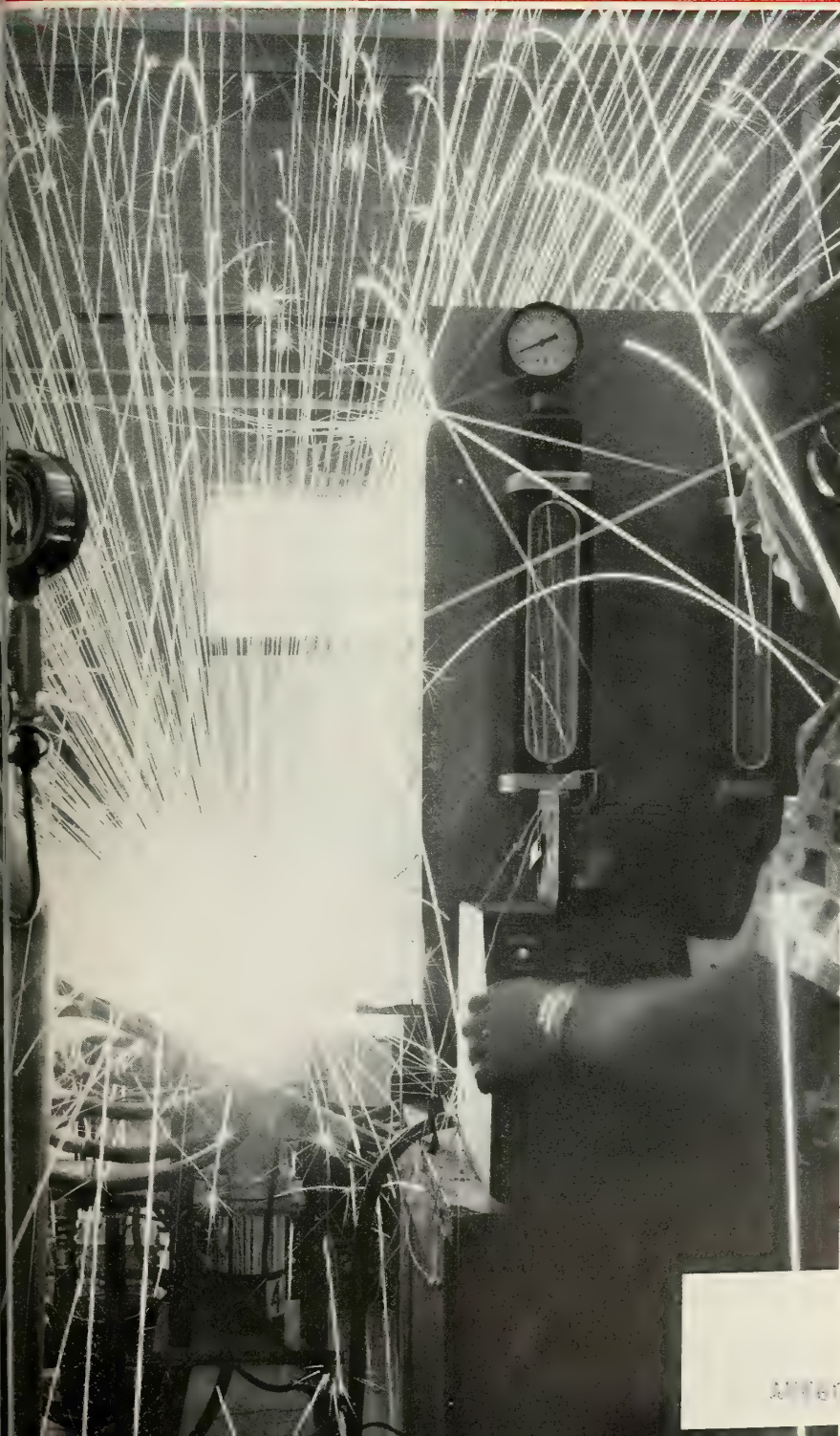


missiles and rockets

THE WEEKLY OF SPACE SYSTEMS ENGINEERING



**Scientists
Call for
Release of
EMP Data**

**Effects of
JFK's Proposal**

**Theodolite for
Saturn Guidance**

**Progress at
Mississippi Site**

CAL Tests Re-entry Materials

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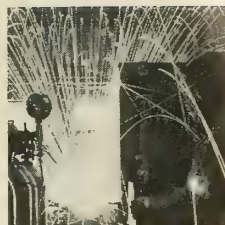
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THE COVER

Droplets of rapidly melting zirconium explode upon oxidation in tests that are part of a program probing effects of re-entry speeds and air densities in reducing material to tiny particles. Materials melting tests are being conducted at Cornell Aeronautical Lab.



➤ **SEPTEMBER 30 HEADLINES**

Scientists Urge Declassification of EMP Data	23
Senate Promises Safeguards After Treaty Passage	23
Congress to Hammer Out Final DOD Money Bill	24
NASA Fund Cut Seen in Wake of Kennedy Proposal	25
SAE Meeting Discusses Varied Aerospace Topics	27
December Target Set for Navy Revamp Completion	31
New Astronaut Selection Expected Soon	32
First Mississippi Facility Test Set for Mid-'65	37

➤ **SPACE SYSTEMS**

Economical Launcher Should Broaden Research Base	43
--	----

➤ **ADVANCED MATERIALS®**

Brazing Process May Find Space Application	48
--	----

➤ **SPACE NAVIGATION**

Rendezvous Control by Astronauts Urged	56
--	----

➤ **SPACE GUIDANCE**

Saturn Theodolite System Tested at Cape Canaveral	62
---	----

➤ **DEPARTMENTS**

Letters	9	Contracts/Procurements	74
The Countdown	17	Products & Processes	76
The Missile/Space Week®	18	Names in the News	82
Technical Countdown	41	When & Where	84
The Industry Week	71	Editorial	86

46,500 copies this issue

Release of EMP Data Urged

Goldwater enters joint paper in Congressional record during test ban treaty debate; weapon systems 'hardening' advocated

by Heather M. David

TWO U.S. SCIENTISTS have called for a change in military specifications for missile systems and a hardening of existing strategic and tactical weapons to protect them against the electromagnetic effects of nuclear explosions (M/R, Sept. 16, p. 14; Sept. 23, p. 19).

Dr. John A. Kuypers of Stanford University and Dr. V. W. Vodicka, technical director of Joslyn Electronic Systems Division, called for a release of classified information on the electromagnetic pulse (EMP) effects on weapons, command and communication systems. Dr. Kuypers told MISILES AND ROCKETS that some scientists have recognized the problem since the early nuclear tests were made, but security clamps were put upon these data.

Sen. Barry Goldwater (R-Ariz.) presented the views of the scientists

when he entered the draft of a still-unpublished paper written by them in the Congressional Record during the nuclear test-ban treaty debate.

The scientists said most of the significant data are available only through unclassified technical journals from the USSR, France and Britain, and from those U.S. scientists who are not silenced by government security. They added that there is no handbook which can be used by systems designers as an information source.

The authors charged that "the present Mil-Spec series is completely inadequate to meet the total reliability requirements of communications and weapons systems facilities." It does not recognize the real integrated EMP problem, they said. When some of the effects are recognized, but systems solution is not readily apparent, "the problem is classified and withheld from

personnel who must have the information in order to design systems that will accommodate the problem."

● **Solutions available**—There is no need to resort to exotic methods to find a method of reducing the vulnerability of existing facilities and future systems, the scientists said. Fast response, self-healing circuit protection devices "will materially reduce" the damage area. Feasible new transmission systems could be far more immune to electromagnetic effects than present techniques.

At present, the authors said, while strategic and tactical defense/offense forces are designed to withstand tremendous physical shock and radiation levels, "they may not dependably survive the electromagnetic nuclear environment."

Catastrophic electrical and electronic failures—vaporization and ex-

Treaty to be Backed by Military Safeguards

THE SENATE Preparedness Subcommittee has promised it will periodically report on whether proper military safeguards are being taken in regard to the nuclear test ban treaty, ratified Tuesday, Sept. 24 by an 80-19 vote.

Sen. John Stennis (D-Miss.) outlined for the Senate a number of points the subcommittee will report on, among them a "schedule for the availability of diagnostic, delivery and sampling aircraft; completion dates for Johnston Island test facilities; commitments on the availability of rocketry and specialized instru-

mentation for high-altitude and anti-ballistic missile systems tests; information on plans for the acquisition and use of testing ranges; and a clear indication of effective planning for the conduct of annual exercises by the joint task force to perform and to perfect high-altitude and anti-ballistic missile experimentation, if the need and the opportunity should arise."

Stennis also scored the Dept. of Defense for keeping classified the testimony on the military need for the high-yield bomb. He said this testimony "would serve to lay this

question to rest once and for all. . . ."

Stennis presented a telegram he had sent to Defense Secretary McNamara Sept. 16 asking that the testimony be released, since other testimony given at the same time against the need for a high-yield bomb had been declassified.

The majority of the 19 Senators who voted against the treaty cited their fear that the Russians had gained knowledge about the weapons effects of high-yield explosions which would give them an advantage over the U.S. until this country acquired the same information.

plosion of electrical conductors, equipment component burnout (especially solid-state devices) and massive insulation failures, and ionization of dielectrics—can be expected in most military facilities that are combined with commercial facilities. From ground zero, they would be affected up to these radii: 1MT fusion, low altitude, 20 miles; 10 MT, 72 miles; and 50 MT, 120 miles. Other scientists predict these effects may reach farther (M/R Sept. 9, p. 18).

Other effects, in a lesser degree, will occur outside these radii. These might include damaged or blown circuit breakers; computer confusion caused by unexpected ground loops, transient pulses and unprogrammed events and instructions, component failure, grounded protectors, blown fuses and disturbance of data-transmission facilities.

The electromagnetic pulse effect, the scientists said, has demonstrated its power in every nuclear test shot. It contributed to most of the instrumentation failures in early test attempts, and continues to cause trouble because systems engineers do not recognize or understand it.

"The effect causes potential changes on conductors in excess of 10,000 volts with rise times on the order of 20 to 100 nanoseconds and durations of one second or more," the West Coast authors said.

In early low-yield fission test activities, failures occurred on powerlines in the area of the tests. Circuit breakers on main feed lines more than 80 miles away opened because of over-voltage conditions. Critics of the test ban treaty, including SAC Commander Gen. Thomas S. Power, expressed fear that the Soviets found out in their high-yield tests that these high-yield electromagnetic pulse effects were even more devastating.

● **Argus tests**—Kuypers said he has been pressing for release of information on EMP since the late 1950's. Through reading stories on Soviet instrumentation of the U.S. tests, the shot times of Argus explosions could be exactly defined. Dramatic and unpredicted electromagnetic disturbances occurred at these times.

The undersea coaxial cable across the North Atlantic Ocean intermittently failed as a result of a low-yield shot at 200 miles altitude. At the same time, critical defense systems suffered outages, but these were not published because of classification.

Examination of other commercial and military communications showed the same correlation. Natural and man-made electromagnetic phenomena daily cause systems troubles, the authors added.

Fusion effects listed by the scientists: **Argus effect**—An aurora-like mechanism noted in every high-altitude test, both U.S. and Soviet, which can create a man-made aurora equal to any recorded solar flare storm.

Electromagnetic pulse effect—Can affect buried cable in vicinity as well as aerial facilities. Conductor burnout in the immediate vicinity and high voltages passed down the line to remote electrical/electronic facilities occur from insulation breakdown.

Neutron flux effect—Abnormal voltages are developed in electrical conductors, accompanied by breakdown of insulation from heat, chemical change and electrical stress. Secondary radiation is also initiated along the flux path. This effect may be masked by the electromagnetic pulse effect.

Static discharge effect—Affects above-ground facilities such as radio antennas, which attract massive electrical discharges from the nuclear fire-

ball edge, much as a lightning rod attracts lightning. Structural components may be melted by these currents.

Radio frequency transmission effects—While not enough quantitative data correlation work has been done in this field, the authors say "Large outages in low-frequency and ultra-low frequency transmission systems have been experienced in connection with nuclear testing, and are to be reckoned with when examining systems reliability in the nuclear environment.

The authors called for a "focal point" to gather all this information together and make it available. While some classified material may be available on a need-to-know basis to systems designers, the problem itself has been hidden, and the sources on the subject are so diverse and "not always in themselves knowledgeable as to the practical results in working systems aspects," they said. ■

House, Senate Confer on DOD Budget

THE DEPARTMENT of Defense appropriations bill is expected to meet final Congressional action sometime this week when Senate and House conferees meet to iron out the differences in their two bills.

Representatives of the two bodies must compromise on a \$258-million difference—the House bill providing for only \$47.082 billion, the Senate \$47.341 billion. Although the Senate originally voted \$289 million more than the House, a last-minute reduction of \$31 million in procurement was announced by Sen. Richard B. Russell (D—Ga.), chairman of the Defense Appropriations Subcommittee, when the bill reached the Senate floor.

The Senate passed the DOD appropriations bill 77 to 0, but earlier narrowly missed cutting it further on the Senate floor. An amendment proposed by Sen. Leverett Saltonstall (R—Mass.), calling for a general 1% reduction in procurement, was defeated by only one vote, 44-43. This measure would have cut a further \$157 million.

Also resoundingly defeated was an amendment to cut the bill by \$2.2 billion, and another to cut out the \$60 million in funds restored for the *Mobile Medium Range Ballistic Missile (MMRBM)*. This is expected to be a sensitive item in conference, because while the House bill cut \$100 million from the Administration re-

quest (leaving \$43 million), the Secretary of Defense did not request restoration of these funds. However, the Senate put back \$60 million after the Joint Chiefs of Staff testified that cutting the funds would set the program back 12 to 18 months.

Still, the feeling expressed by the amendment's author, Sen. William Proxmire (D—Wis.), that he wasn't convinced the Secretary really planned to go ahead with the development of *MMRBM*, is shared by others in Congress.

Failure of the Senate to restore the total amount cut in Air Force R&D probably will result in further stretch-out in the *Aerospace Plane* program, Pentagon spokesmen say. Earlier, DOD said the program would be cut back to \$6.5 million if the Senate upheld the general 3% across-the-board reduction in R&D. Although the Senate added \$67 million, to the House bill, this was confined to *MMRBM* and a classified project.

The Air Force has implied that a limited amount of effort will continue in some of the advanced categories of development of *Aerospace Plane*. Originally, the \$19 million requested for FY 1964 work would have supported efforts in advanced liquid air cycle engines, supersonic combustion, Mach 8 ramjet, an air separator device, turbo-accelerator and advanced structures.